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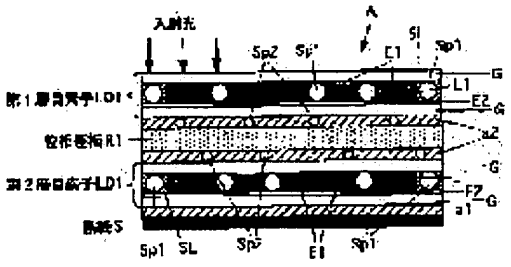
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a liquid crystal display device in which the color balance can be easily controlled, a two-dimensional image or three-dimensional image can be brightly displayed with desired color balance, and which has high resistance against vibration or impact, and which causes little decrease in the image display quality for a high definition image.

SOLUTION: This liquid crystal display device A is produced by laminating plural layers of liquid crystal display devices LD1 each having a liquid crystal L1 showing a cholesteric phase with selective reflection wavelengths in the visible ray region. A phase difference plate R1 (a layer having double refraction) is disposed between adjacent liquid crystal display devices LD1, and the phase difference plate R1 is adhered and fixed with an adhesive layer a2 to the adjacent liquid crystal display device LD1.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a liquid crystal display and the liquid crystal display by the liquid crystal in which the cholesteric phase which has selective reflection wavelength in a light region especially is shown.
[0002]
[Description of the Prior Art] In order to display on the liquid crystal display (it may be hereafter called a "cholesteric-liquid-crystal display") by the liquid crystal in which the cholesteric phase which has selective reflection wavelength in a light region is shown by carrying out selective reflection of the light of specific wavelength, there is an advantage that a back light is unnecessary, and visibility is expected as a good display with little power consumption. On the other hand, such a liquid crystal display has generally the problem that modification of a reflection factor with a low (a display is not bright) reflection factor is difficult.
[0003] When furthermore explained, the liquid crystal display by the liquid crystal in which the cholesteric phase which has selective reflection wavelength in the conventional light region is shown first reflects only the circular polarization of light of either right-handed rotation or left-handed rotation, it could not reflect but another circular polarization of light was made to penetrate altogether. In such a display, since only the light of the one half of incident light was used, a high reflection factor was not obtained.
[0004] Moreover, about the point of modification of a reflection factor, it is as follows. The reflection factor by selective reflection influences the color balance in a color liquid crystal display, and it becomes important especially color balancing it (RGB balance of each reflection factor) in the cholesteric-liquid-crystal indicating equipment of a RGB laminating mold (type which carried out the laminating of a red display layer, a green display layer, and the blue display layer).
[0005] Color balance is an element very important for a electrochromatic display. For example, the white (color recognized that a large majority of men are pure white) which Japanese people recognize has many people sensed by "bluish white" in Europe and America. On the contrary, there are many people in whom Japanese people sense European and American white as "the white appropriate for yellow." The color balance of a film is mentioned in a familiar example. Seemingly oil painting is yellow (or brown) compared with a Japanese film. When two or more human beings look at the color same in short, individual difference (the sensibility difference of an eye is natural difference in an area or culture) appears in recognition of a color.
[0006] If adjustment of color balance can be performed simply, the display of different color balance for every user can produce easily (supply). For example, it comes to be able to perform easily supplying appropriate yellow from the display supplied in Japan to the West. And it depends for the reflection factor by selective reflection on the helical pitch of liquid crystal and the thickness of a liquid crystal layer which show a cholesteric phase. Therefore, or it strengthens a reflection factor a little, when weakening, modification of a liquid crystal ingredient or modification of the thickness of a liquid crystal

layer is needed, but if the thickness of a liquid crystal ingredient or a liquid crystal layer is changed, the optimal actuation conditions, such as driver voltage, will also change. Therefore, modification of a reflection factor was dramatically difficult.

[0007] Thus, in the conventional cholesteric-liquid-crystal indicating equipment, there was a problem of difficulty (modification of color balance is difficult) in modification of a reflection factor with a low reflection factor. The attempt which solves such a problem on the other hand has also been made. JP,7-287214,A is teaching reflecting the circular polarization of light light of both right handed rotation and the left rotatory polarization by carrying out the laminating of a clockwise cholesteric-liquid-crystal layer and the counterclockwise cholesteric-liquid-crystal layer. If this technique is used, improvement in a reflection factor is expectable.

[0008] JP,10-142593,A is indicating the reflective mold liquid crystal display component which prepared the detached core between two liquid crystal devices which come to pinch a liquid crystal layer to the transparence substrate of a couple, respectively, the 2 laminatings of what pinched the cholesteric-liquid-crystal layer of the same surroundings between the transparence substrates of a couple are carried out to drawing 2 of this official report, and the liquid crystal display which prepared the separation member which consists of an optical compensation component which has optical activity in the meantime is indicated. If this technique is used, the ease of the improvement in a reflection factor and reflection factor modification is expectable.

[0009]

[Problem(s) to be Solved by the Invention] However, although the improvement in a reflection factor is expectable if the laminating of a clockwise cholesteric-liquid-crystal layer and the counterclockwise cholesteric-liquid-crystal layer is carried out that JP,7-287214,A teaches, modification of a reflection factor is still difficult. Namely, in order to depend for the reflection factor on the helical pitch of liquid crystal and the thickness of a liquid crystal layer which show a cholesteric phase as stated above and to change a reflection factor For example, when to want you to lower a reflection factor a little from a user is demanded, modification of a liquid crystal ingredient or modification of the thickness of a liquid crystal layer is needed, and actuation conditions, such as driver voltage, must also be examined in connection with it, and adjustment (modification) of a reflection factor is still very difficult.

[0010] Moreover, in order to use the both sides of the cholesteric-liquid-crystal layer of right-handed rotation and left-handed rotation, the burden in the activity of material selection becomes large. In the liquid crystal display which JP,10-142593,A teaches, since the number of the interfaces formed between liquid crystal display components compared with the case where this separation member is not prepared by having arranged the separation member which consists of an optical compensation component which has optical activity between liquid crystal display components doubles while the improvement [in a reflection factor] and easy disposition top of adjustment of a reflection factor is expectable, there is a possibility may cause deterioration of display grace. namely, to JP,10-142593,A So that there may be no publication about immobilization between the separation members and liquid crystal display components which have optical activity and it may be indicated by this official report Minute space is formed [only pinching this separation member between liquid crystal display components, and] between a separation member and an upper liquid crystal display component and between a separation member and a lower liquid crystal display component, this becomes a cause, an echo and dispersion of the light in an interface are produced, and there is a possibility of leading to deterioration of display grace.

[0011] Moreover, it cannot be said that display nature and visibility are excellent in only pinching this separation member between liquid crystal display components. It is because gap arises in the display of the upper layer and a lower layer. If it puts in another way, gap will occur in the pixel of an upper liquid crystal layer and a downward liquid crystal layer. If an oscillation and an impact are added especially, the upper layer and a lower layer will shift greatly. If pixel gap takes place, the display grace of a display device will fall remarkably (it will become the display to which the edge of an image faded and which spread). Highly minute-ization of a display device is called for, and in a highly minute display, the effect of a pixel gap is large and is not desirable as a highly minute display recently.

[0012] Then, even if display grace of this invention is high and adjustment of color balance is easy, and it can display a two-dimensional image brightly and makes it highly minute against an oscillation or an impact strongly in desired color balance, deterioration of image display grace makes it a technical problem to offer few liquid crystal displays. Moreover, even if this invention can also perform the display of a three-dimension image and it not only can display a two-dimensional image brightly, but makes it highly minute against an oscillation or an impact strongly in desired color balance, it makes it a technical problem for deterioration of image display grace to offer few liquid crystal displays.
[0013]
[Means for Solving the Problem] In order that this invention person might solve said technical problem, he repeated examination and acquired the following knowledge. If the 2 laminatings of the liquid crystal display component which has the liquid crystal in which the cholesteric phase which has selective reflection wavelength in a light region is shown are carried out, for example and a phase contrast plate (layer which has birefringence) is inserted among these components, the high reflective mold liquid crystal display of a reflection factor is realizable with the principle explained below. Moreover, a reflection factor can be freely set up easily with the magnitude of the retardation of the phase contrast plate to insert.
[0014] That is, as shown in drawing 11 , in the visible range of the clockwise circular polarization of light or the counterclockwise circular polarization of light (either), selective reflection of the incident light is first carried out by upper component **. If another [which did not carry out selective reflection] circular polarization of light penetrates component ** and phase contrast plate ** is penetrated, a phase will shift and it will turn into polarization of the circumference of reverse, or elliptically polarized light. Incidence of the polarization which became a circumference of elliptically polarized light or reverse is carried out to lower component **. Selective reflection of the light which carried out incidence is carried out by lower component ** (it depends for the amount of reflected lights at this time on the magnitude of the retardation of phase contrast plate **). The light in which selective reflection was carried out by lower component ** penetrates phase contrast plate ** again, turns into elliptically polarized light or the circular polarization of light of the circumference of reverse (it depends for this polarization condition on the magnitude of the retardation of a phase contrast plate), and penetrates upper component **. It depends for the amount of transmitted lights at this time on the magnitude of the retardation of phase contrast plate **.
[0015] A reflection factor can be freely set up easily with the magnitude of the retardation of phase contrast plate ** which can display a two-dimensional image brightly in this way, and is inserted. Moreover, even if it fixes both components of each other, it can control the pixel gap between vertical both components by doing so by changing into a condition strong against an oscillation or an impact and it makes it highly minute by pasting up phase contrast plate ** on the both sides of upper component ** and lower component **, deterioration of display grace decreases.
[0016] Moreover, it is prevented, and that between a phase contrast plate and upper liquid crystal display components and between a phase contrast plate and lower liquid crystal display components are filled by the adhesives layer, and minute space is formed can control an echo and dispersion of the light in an interface, and it can prevent deterioration of display grace. Furthermore, the image display by upper component ** and the image display by lower component ** are changed, and image display of a three-dimension image can also be performed.
[0017] If it furthermore explains, when - couple is the same or the peak wavelength of selective reflection sandwiches the phase contrast plate which has the retardation of the one half of the peak wavelength of selective reflection between the liquid crystal display components which have the liquid crystal in which the cholesteric phase of the affiliated color of the couple which approached mutually is shown, a high reflection factor will be obtained.
- If the magnitude of the retardation of the phase contrast plate inserted between the liquid crystal display components which have the liquid crystal in which a cholesteric phase is shown is changed, the magnitude of maximum reflectance will also change. That is, a reflection factor can be changed.
- What is necessary is just to change the magnitude of the retardation of a phase contrast plate in the

cholesteric-liquid-crystal indicating equipment of a RGB laminating mold, in order to change color balance. Modification of a liquid crystal ingredient or thickness modification of a liquid crystal layer is unnecessary. Since there is no modification in the thickness of a liquid crystal ingredient or a liquid crystal layer, the optimal driver voltage conditions do not change, either. In this way, in a RGB laminating mold liquid crystal display, modification of color balance is easy, and desired color balance can be obtained easily.

- If the image with which it differs for displaying a solid image on each it of two liquid crystal display components which carried out the laminating is displayed and an observer looks at this with the glasses using a right-handed-rotation circular polarization of light transparency filter and a left-handed-rotation circular polarization of light transparency filter, a three-dimension image can be seen.

[0018] For example, in the liquid crystal display which carried out the laminating of the liquid crystal display component, the liquid crystal display component of the 1st layer presupposes that the clockwise circular polarization of light is reflected and the liquid crystal display (it had phase contrast plate) component of the 2nd layer reflects the counterclockwise circular polarization of light. When the image of both components is seen using the glasses which equipped the right eye side with the right-handed-rotation circular polarization of light transparency filter, and equipped the left eye side with the left-handed-rotation circular polarization of light transparency filter, the image of the liquid crystal display component of the 1st layer is visible to a right eye, and the image of the component of the 2nd layer is visible to a left eye. Therefore, if an indication which is different for the liquid crystal display component of the 1st layer and the 2nd layer is given, a display which is different in a right eye and a left eye can be made to observe, and this will become observable [a three-dimension image].

[0019] This invention offers the following (1) and the liquid crystal display of two types of (2) fundamentally based on the above knowledge. Two or more laminatings of the liquid crystal display component which comes to pinch the liquid crystal in which the cholesteric phase which has selective reflection wavelength in the 1st liquid crystal display light region is shown between the substrates of a couple are carried out. (1) -- [namely,] The liquid crystal display characterized by carrying out adhesion immobilization of the layer which the layer which has birefringence is made to be placed between at least one between the substrates of each next door **** liquid crystal display component, and has this birefringence by the glue line at the substrate of two liquid crystal display components which adjoin it, respectively.

[0020] The spacer may be contained in the glue line arranged on the top face and underside of a layer which have said birefringence. Moreover, adhesion immobilization may be mutually carried out by the glue line also about between the adjacent liquid crystal display components which do not contain in between the layer which has birefringence. The spacer may be contained also in this glue line.

[0021] Anyway, as said glue line, an acrylic glue line and an ultraviolet curing mold resin layer can be illustrated. About these advantages, it mentions later. In addition, all substrates may have birefringence. (2) Equip the 2nd liquid crystal display light region with two or more substrates which pinch the liquid crystal layer which shows the cholesteric phase which has selective reflection wavelength, and this liquid crystal layer, respectively. It is the liquid crystal display which makes the configuration that two or more laminatings of the liquid crystal display component were carried out. The liquid crystal display characterized by having at least one component laminating configuration by which the substrate which serves as the layer which has birefringence at least between liquid crystal layers while the configuration to which the laminating of the two liquid crystal display components was carried out is shown is arranged.

[0022] The substrate which was pasted up by the glue line and which serves as the layer which has said birefringence, and other substrates may be contained in the part of said component laminating configuration as a substrate between liquid crystal layers. The spacer may be contained in this glue line. which 1st and 2nd liquid crystal display explained above -- be -- the following can be illustrated further. ** The liquid crystal display in which the pixel of one component and the pixel of the component of another side are carrying out abbreviation lap coincidence in the part of the component laminating configuration in which the layer which has birefringence between liquid crystal layers while the

configuration to which the laminating of the two liquid crystal display components was carried out is shown is contained.
[0023] In this case, the configuration to which the laminating of the two liquid crystal display components was carried out is shown, and it is desirable that the pixel of one component and the pixel of the component of another side are carrying out abbreviation lap coincidence also in the part of the component laminating configuration in which the layer which has birefringence between liquid crystal layers is not contained.
Adjoin each other mutually among said two or more liquid crystal display components, and even if few, ** The liquid crystal display component of a lot The wavelength of 360nm - 520nm blue glow, the wavelength of 520nm - 620nm green light, The liquid crystal display with which it is the liquid crystal display component of the same color system to which the peak wavelength of selective reflection exists in one range of the wavelength of 620-760nm red light, and the layer which has said birefringence between liquid crystal layers in the part of the component laminating configuration which shows the configuration to which the laminating of the liquid crystal display component of this same color system was carried out is contained.
[0024] The 1st which has the peak wavelength of selective reflection as said liquid crystal display component as an example of this liquid crystal display to the 1st wavelength field chosen from said three sorts of wavelength fields, and the 2nd liquid crystal display component, The 3rd [which has the peak wavelength of selective reflection to the 2nd wavelength field chosen from said three sorts of wavelength fields], and 4th liquid crystal display components are included. The component laminating configuration by which the laminating was carried out in the sequence of the 1st liquid crystal display component, the 3rd liquid crystal display component, the 4th liquid crystal display component, and the 2nd liquid crystal display component is taken. The liquid crystal display with which the layer which has [in the list between liquid crystal layers of the 1st and 3rd liquid crystal display components] birefringence, respectively between the liquid crystal layers of the 2nd and 4th liquid crystal display components is arranged can be mentioned.
[0025] Moreover, the retardation of a layer which has said birefringence can also illustrate the liquid crystal display whose optical incidence side is the magnitude of the one half of the peak wavelength of the selective reflection wavelength of the liquid crystal display component located in an opposite hand among two adjacent liquid crystal display components by which the layer which has this birefringence is arranged between liquid crystal layers.
** the liquid crystal display component with the same liquid crystal display component of a lot at least which adjoins each other mutually among said two or more liquid crystal display components -- it is -- this next door **** -- the liquid crystal display with which the layer which has birefringence between the liquid crystal layers of the same liquid crystal display component is arranged.
** the layer which has said birefringence -- the inside of the liquid crystal of two or more liquid crystal display components -- most -- a long wave -- the liquid crystal display which is the layer which has the retardation below the peak wavelength of the selective reflection which is merit.
** The liquid crystal in each of two or more of said liquid crystal display components The peak wavelength of selective reflection The wavelength of 360nm - 520nm blue glow, It exists in either range of the wavelength of 520nm - 620nm green light, and the wavelength of 620-760nm red light. The liquid crystal display which has the liquid crystal display component containing the liquid crystal whose peak wavelength of selective reflection is the wavelength of this blue glow, a liquid crystal display component containing the liquid crystal which is the wavelength of this green light, and at least one liquid crystal display component containing the liquid crystal which is the wavelength of this red light, respectively.
[0026] The following liquid crystal display can be mentioned as an example of this liquid crystal display.
a) The liquid crystal display with which at least one component laminated structure by which the layer which has birefringence between two liquid crystal layers of a liquid crystal display component which have the peak wavelength of selective reflection in the same wavelength field among said three sorts of

wavelength fields is arranged is contained.
b) The liquid crystal display with which the 3 laminatings of the component laminated structure by which the layer which has birefringence between two liquid crystal layers of a liquid crystal display component which have the peak wavelength of selective reflection in the same wavelength field among said three sorts of wavelength fields is arranged are carried out.
[0027] c) The liquid crystal display with which at least one component laminated structure by which the layer which has birefringence between two liquid crystal layers of the same liquid crystal display component is arranged is contained.
d) The liquid crystal display with which the 3 laminatings of the component laminated structure by which the layer which has birefringence between two liquid crystal layers of the same liquid crystal display component is arranged are carried out.
** The liquid crystal display with which the liquid crystal display component from which the peak wavelength of selective reflection wavelength differs mutually is contained in said two or more liquid crystal display components, and the peak wavelength of selective reflection wavelength is arranged from the optical incidence side in order of the short liquid crystal display component.
** The liquid crystal display equipped with two or more component laminated structures by which the layer which has birefringence between the liquid crystal layers of an adjacent liquid crystal display component is arranged.
[0028] The layer which has two or more birefringence may be the same.
With the optical incidence side of the liquid crystal display component of the lot which contains the layer which has birefringence between liquid crystal layers, ** To an opposite hand The liquid crystal display component which is the component laminated structure which comes to arrange the laminating liquid crystal display component which carried out the laminating of one liquid crystal display component or two or more liquid crystal display components, and is in an opposite hand with an optical incidence side among the liquid crystal display components of the lot containing the layer which has said birefringence, The liquid crystal display containing at least one component laminated structure by which the layer which has the birefringence at which a lagging axis crosses 90 degrees to the lagging axis of a layer which has said birefringence between said one liquid crystal display component or said laminating liquid crystal display component has been arranged.
** The liquid crystal display which enabled it to observe a solid image through observation equipment equipped with two kinds of the light filters which penetrate only the image which the liquid crystal display component of the adjacent lot containing the layer which has birefringence displays by reflecting the incident light of the circular polarization of light of reverse, respectively between liquid-crystal layers, and the component actuator which displays the image which has parallax mutually is connected to each component, and is displayed on the liquid crystal display component of this lot, respectively.
[0029]
[Embodiment of the Invention] It explains also combining liquid crystal display ****** concerning the gestalt of operation of this invention, and its manufacture approach hereafter, and referring to a drawing. The liquid crystal display of the 1st operation gestalt with desirable this invention carries out two or more laminatings of the liquid crystal display component which comes to pinch the liquid crystal in which the cholesteric phase which has selective reflection wavelength in a light region is shown between the substrates of a couple. The layer which has birefringence is made to be placed between at least one between the substrates of each next door **** liquid crystal display component. And adhesion immobilization has been carried out by the glue line in the layer which has this birefringence at the substrate of two liquid crystal display components which adjoin it, respectively.
[0030] This liquid crystal display can be manufactured as follows, for example. That is, the liquid crystal display component which pinched the liquid crystal in which the cholesteric phase which has selective reflection wavelength in a light region between two substrates (film substrates, such as a glass substrate, and PES, PET etc.) with which at least one side has transparency, and has an electrode is shown is produced. Two or more laminatings of the produced liquid crystal display component are carried out, and the layer which has birefringence in at least one in between these liquid crystal display

components is made to intervene. A glue line is made to intervene between each next door **** liquid crystal display component between each next door **** liquid crystal display component and the layer which has birefringence, and adhesion immobilization of what adjoin each other by this glue line is carried out. at this time, adhesion immobilization is carried out so that the pixel of each liquid crystal display component may be mostly in agreement (**** -- like). The liquid crystal display of the 1st operation gestalt of this invention can be manufactured in this way.

[0031] The chiral pneumatic liquid crystal which added the chiral ingredient so that a predetermined helical pitch might be obtained by cholesteric liquid crystal and the pneumatic liquid crystal as liquid crystal in which the cholesteric phase which has selective reflection wavelength in said light region is shown can be illustrated. In order to drive the produced liquid crystal display, at least two kinds of pulse voltages from which the magnitude of energy differs, for example, the pulse voltage whose electrical-potential-difference values are two kinds of height, are impressed to the pixel of each liquid crystal display component.

[0032] For example, a retardation adopts lambda/2 (1/2 wave) of phase contrast plates as a layer which has birefringence. In the liquid crystal display of a configuration of having pinched the two right-handed-rotation circular polarization of lights by the cholesteric-liquid-crystal display device (display device by the liquid crystal in which a cholesteric phase is shown) which carries out selective reflection If a high pulse voltage is impressed to two liquid crystal display components, equipment will carry out selective reflection of the light of the color corresponding to it with the helical pitch of the liquid crystal layer adjusted beforehand, if the die length of a pitch is in the wavelength of the light. This is considered to be for taking a planar array by the helical shaft which had turned to the random direction by the initial state being assembled in the direction vertical to a component substrate by electrical-potential-difference impression. That of the 1st layer and a layer [2nd] liquid crystal layer take a planar array by gathering in the direction where a helical shaft is vertical to a component substrate. If the light (light to which the circular polarization of light of right-handed rotation and left-handed rotation was joined) from the sun or a fluorescent light carries out incidence to the 1st layer, selective reflection will start to the clockwise circular polarization of light, and outgoing radiation of the selective reflection light will be carried out to an incident light side. The counterclockwise circular polarization of light penetrates a first pass eye, and it carries out incidence to a phase contrast plate. When the circular polarization of light light of the left-handed rotation which carries out incidence penetrates a phase contrast plate, a polarization condition changes. If a phase contrast plate with lambda/2 of retardations is penetrated, a polarization condition will change, and a counterclockwise circular polarization of light light will turn into the clockwise circular polarization of light, and will carry out incidence to the 2nd layer. Selective reflection starts the circular polarization of light of the right-handed rotation which carried out incidence to the 2nd layer by the layer [2nd] liquid crystal layer. Incidence of the light by which selective reflection was carried out is carried out to a phase contrast plate. If a phase contrast plate is penetrated, a polarization condition will change, it will become the circular polarization of light of the left rotatory polarization, a layer [1st] liquid crystal layer will be penetrated, and outgoing radiation will be carried out to an incident light side.

[0033] Furthermore, when a low pulse voltage is impressed to the display of this condition, for example, a display shows a drastic change transparence condition and shows high permeability. This is considered to be for taking a focal conic array because the uniformity of the shaft orientations of a helical shaft collapses by electrical-potential-difference impression, consequently a shaft turns to a random direction. After pulse-voltage impression is held at stability, and said two conditions show a bistability, respectively. If a pulse voltage with the energy of in-between magnitude is impressed, the middle condition of said two conditions can also be chosen as a stable state.

[0034] Only the clockwise circular polarization of light can be reflected only by carrying out the laminating of the cholesteric-liquid-crystal display device which carries out selective reflection only of the right-handed-rotation circular polarization of light. However, by inserting a phase contrast plate as mentioned above between them, the polarization condition of the circular polarization of light of the left-handed rotation to penetrate is changed, and selective reflection (circular polarization of light which was

left-handed rotation) becomes possible in a layer [2nd] liquid crystal layer. That is, selective reflection will be carried out about the circular polarization of light of the circumference of both to incident light (light to which the circular polarization of light of right-handed rotation and left-handed rotation was joined).

[0035] Therefore, so high a reflection factor is obtained. Moreover, it is possible by increasing or decreasing the retardation of a phase contrast plate focusing on lambda/2 to change a reflection factor. In the case of the liquid crystal which the liquid crystal in which the cholesteric phase in the liquid crystal display component which carries out a laminating is shown shows a right-handed-rotation cholesteric phase, and the liquid crystal in which a left rotatory-polarization cholesteric phase is shown, a reflection factor can be changed by a reflection factor being the lowest when the retardation of a phase contrast plate is lambda/2, and making a retardation fluctuate focusing on lambda/2.

[0036] If an observer covers the observation equipment (for example, glasses, such as such sunglasses) using a right-handed-rotation circular polarization of light transparency filter and a left-handed-rotation circular polarization of light transparency filter, it is also possible to see a three-dimension image. For example, suppose that a phase contrast plate is pinched, the liquid crystal display component of the 1st layer reflects the clockwise circular polarization of light, and the liquid crystal display component of the 2nd layer reflects the counterclockwise circular polarization of light between the same liquid crystal display components. Then, when the image of both components is seen covering the glasses with which the observer equipped the right eye side with the right-handed-rotation circular polarization of light transparency filter, and equipped the left eye side with the left-handed-rotation circular polarization of light transparency filter, the image of the liquid crystal display component of the 1st layer is visible to a right eye, and the image of the component of the 2nd layer is visible to a left eye. Therefore, if an indication which is different for the liquid crystal display component of the 1st layer and the 2nd layer is given, a display which is different in a right eye and a left eye can be made to observe, and this will become observable [a three-dimension image]. Such a thing cannot be performed in the display by the liquid crystal in which the conventional cholesteric phase which reflects only circular polarization of light of one of the two is shown.

[0037] Although adhesion immobilization of what a glue line is made to intervene between each next door **** liquid crystal display component in the liquid crystal display of the 1st operation gestalt of aforementioned this invention between each next door **** liquid crystal display component and the layer which has birefringence, and adjoin each other by this glue line is carried out Supposing it does not adopt such a glue line, a minute clearance will be formed between the substrate of the liquid crystal display component of between the substrate of an upper liquid crystal display component, and the layers (in the case of aforementioned phase contrast plate) which have birefringence, and the bottom, and the layer which has birefringence. Since the refractive indexes of the substrate (about 1.8 when it is glass and is refractive-index about 1.5 film) of an air space (refractive index 1) and a liquid crystal display component differ greatly when air is fulfilled and an air space is formed in this clearance, an echo will take place by the interface. Moreover, the same thing will happen also in an air space and the layer (in the case of aforementioned phase contrast plate) which has birefringence. Then, it is better for a layer with the refractive index near [air] the substrate (or layer which has birefringence) of a liquid crystal display component to be in between as for close. Since glue line inclusion is carried out among what adjoin each other in said liquid crystal display, the echo by the interface of adjacent things can be reduced and deterioration of the display grace of a liquid crystal display can be prevented so much.

[0038] Moreover, since adhesion immobilization of what adjoin each other by the glue line is carried out, generating of pixel gap can be prevented between adjacent display devices, and it has become the display of a laminating mold strong against an oscillation or an impact. From it being hard to generate pixel gap, even if it makes it highly minute, deterioration of display grace is controlled. Moreover, since the thickness of a glue line is maintained at homogeneity when the spacer is added by the glue line, deterioration of display grace can be prevented.

[0039] Next, if the effect of the heat to a liquid crystal display etc. is seen, internal stress will also generate the liquid crystal display concerning this invention inside a laminated structure with heat etc.

Photoelasticity deformation will take place to the layer (in the case of aforementioned phase contrast plate) which has birefringence by that cause. So, what eases internal stress (they are control thru/or prevention about photoelasticity deformation) is employable as a glue line. If it furthermore says, what consists of an ingredient which is excellent in stress relaxation nature (what consists of a binder typically) is employable.

[0040] The binder which is excellent in the transparency which comes to use polymers which consist of an acrylic polymer which consists of acrylic resin or its derivative, and silicon resin and its derivative as an ingredient (binder) which is excellent in stress relaxation nature, for example, such as a silicon system polymer and synthetic rubber, can be mentioned. Points, such as transparency and an adhesion property, to an acrylic binder is desirable. Additives, such as tackifiers, such as petroleum system resin, and an antioxidant, can be blended with a binder if needed.

[0041] Anyway, as for a glue line, it is desirable that it is also not only between both sides of a phase contrast plate but between a liquid crystal display component and a liquid crystal display component (between layers without a phase contrast plate). Moreover, if UV (ultraviolet rays) hardening mold resin is used for a glue line, it will become easy to unite the pixel of two or more liquid crystal display components which carry out a laminating. For example, for a liquid crystal display component, after applying UV hardenability resin of non-effectiveness between the layer and carrying out the laminating of all components and phase contrast plates when carrying out the laminating of a component or the phase contrast plate for it to a mark although the alignment mark for location ****** etc. is prepared, the alignment mark of each component is made mostly in agreement, and pixel ****** is usually worked. Then, by irradiating UV light, this resin can be stiffened to all UV hardenability resin, and a component, a phase contrast plate and a component, and a component can be fixed to it.

[0042] In addition, if the charge of a binder with a fluidity is used before hardening of UV hardenability resin ingredient etc. as mentioned above, gap of each class can be tuned finely and the alignment which is a pixel is easy until it irradiates UV light and stiffens the charge of a binder. After checking having made the pixel of all liquid crystal display components mostly in agreement, it can be made to harden collectively, there is almost no defect by pixel gap in the liquid crystal display completed by that cause, and the yield improves. If the spacer is added to the glue line which especially consists of a photo-setting resin ingredient, and it is before hardening of a photo-setting resin ingredient, since it can perform easily shifting the relative position of a substrate pair, maintaining the thickness of a glue line at homogeneity, pixel ****** of two or more liquid crystal display components will become easier with a spacer.

[0043] what the thickness of a glue line becomes from a binder -- be -- what consists of UV hardenability resin -- be -- or the thing which consists of other ingredients -- be -- in order to make thickness of a glue line as thin as possible and to maintain sufficient adhesive strength moreover, it is good to choose from the range of 2 micrometers - 200 micrometers. In order to maintain spacing of a component and a component, and spacing of a component and a phase contrast plate at homogeneity, a glue line can be distributed and a spacer can be used. By distributing a spacer, alignment of each class can be tuned finely more easily.

[0044] As for a glue line, it is desirable that it is also not only between both sides of a phase contrast plate but between a liquid crystal display component and a liquid crystal display component (between layers without a phase contrast plate). The liquid crystal display component of the 2nd operation gestalt with desirable this invention equips the light region with two or more substrates which pinch the liquid crystal layer which shows the cholesteric phase which has selective reflection wavelength, and this liquid crystal layer, respectively, and is a liquid crystal display which makes the configuration that two or more laminatings of the liquid crystal display component were carried out. And while the configuration to which the laminating of the two liquid crystal display components was carried out is shown, it has at least one component laminating configuration by which the substrate which serves as the layer which has birefringence at least between liquid crystal layers is arranged.

[0045] This liquid crystal display can be produced by using the substrate which serves as the layer which has birefringence at least as a substrate located between two liquid crystal layers, in case a liquid

crystal display is produced like said 1st operation gestalt. For example, liquid crystal is pinched and produced with the substrate which has birefringence for one component, and the substrate which does not have birefringence, liquid crystal is pinched and produced between the substrates which do not have the birefringence of two sheets for the component of another side, and a liquid crystal display can be produced by putting the component of another side on the substrate side which has birefringence. The same glue line as the 1st operation gestalt may be prepared in the plane of composition of each component.

[0046] Since this liquid crystal display uses what has birefringence for the substrate itself which pinches a liquid crystal layer, it does not have the interface of a substrate like the 1st operation gestalt, and the layer which has birefringence, and dispersion or the echo originating in this interface do not produce it.

Next, an example is explained with reference to a drawing. In addition, in the following explanation, "clockwise cholesteric liquid crystal" is liquid crystal in which the cholesteric phase which carries out selective reflection of the right-handed-rotation circular polarization of light is shown, and "counterclockwise cholesteric liquid crystal" is liquid crystal in which the cholesteric phase which carries out selective reflection of the left-handed-rotation circular polarization of light is shown.

The liquid crystal display of the gestalt of example 1 drawing 1 was produced. Between the transparent glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The cholesteric liquid crystal L1 (the nematic liquid crystal BL46 by Merck Co. the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation whose peak wavelength of selective reflection is 550nm The spacer Sp1 with a particle size of 7 micrometers is made to intervene, it pinches, and two liquid crystal display components LD 1 which closed liquid crystal by sealant SL so that a viewing area might be surrounded further are produced. These two liquid crystal display components LD 1 are the same liquid crystal display components with completely same a production ingredient and production conditions. In addition, the thing which made the sealing compound (2400 and a curing agent: base resin: ERS- ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as a sealant was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.

[0047] On the black cardboard S with which adhesives a1 (acrylic binder) are applied to the front face, one liquid crystal display component (the 2nd layer) LD 1 is stuck. On the stuck liquid crystal display component, the adhesives (acrylic binder) a2 which added the spacer Sp2 with a particle size of 7 micrometers are applied, and the phase contrast plate R1 (NITTO DENKO CORP. make R-275) is stuck. The adhesives (acrylic binder) a2 which added the spacer Sp2 with a particle size of 7 micrometers are applied on the this retardation 275nm phase contrast plate R1, and the liquid crystal display component (the 1st layer) LD 1 is stuck on it. In addition, among the drawing, since a spacer Sp2 distinguishes from a spacer Sp1, it has drawn on the minor diameter from the spacer Sp1.

[0048] If a low-battery pulse is impressed to each component LD 1 of the liquid crystal display A obtained in this way, a liquid crystal layer will be in a focal conic condition (black display), i.e., transparence, and if a high-tension pulse is impressed, a liquid crystal layer will be in a planar condition, i.e., the selective reflection condition of a specific color. For example, if the pulse voltage of 140V is impressed to each component, the liquid crystal layer L1 of each component will be in a planar condition. The component LD 1 of the 1st layer carries out selective reflection [selective reflection / with a peak of 550nm of right-handed-rotation circular polarization of light light / component / LD 1 / of the 2nd layer] with a peak of 550nm of left rotatory-polarization circular polarization of light light to the incident light to which the circular polarization of light of right handed rotation and the left rotatory polarization was joined in the state of the planar. The light which penetrated the component of the 1st layer and the 2nd layer is absorbed with the black paper S which is an absorption layer.

[0049] This liquid crystal display A presents one about 1.5 times the reflection factor of this as compared with the display which adopted the component LD 1 by the monolayer. Since only the clockwise circular polarization of light can carry out selective reflection with monolayer equipment, a

reflection factor is low. Drawing 10 shows this. In addition, only the reflection factor almost comparable as that for which what stuck the component LD 1 with adhesives, without preparing about two phase differential plates used the component LD 1 by the monolayer was shown.

[0050] In the liquid crystal display A explained above, a reflection factor becomes the largest in the peak wavelength of the selective reflection of the liquid crystal display component LD 1 at the time of one half of the peak wavelength of the selective reflection of the same liquid crystal display component LD 1 for which the retardation which the phase contrast plate R1 has pinches this phase contrast plate. Moreover, each optimal driver voltage of a component two-layer [these] becomes the same by carrying out the laminating of the liquid crystal display component LD 1 same in this way. Therefore, the two-layer liquid crystal display component LD 1 can be operated in the same actuation circuit, and it becomes cost ** so much.

[0051] If the image which has parallax mutually is displayed on the liquid crystal display component LD 1 of the 1st layer and the 2nd layer and an observer will cover the glasses (sunglasses) using a right-handed-rotation circular polarization of light transparency filter and a left-handed-rotation circular polarization of light transparency filter, a three-dimension image (solid image) can be seen. Since the glue line a2 is made to intervene between the phase contrast plate R1 and a component LD 1, the echo by the interface of the phase contrast plate R1 and a component LD 1 can be reduced. Moreover, the pixel of the component of the 1st layer and the pixel of the component of the 2nd layer are being fixed by this glue line a2 in the condition of having been mostly in agreement, it hardly generates but pixel gap is strong against an oscillation or an impact. Moreover, from it being hard to generate pixel gap, even if it makes it highly minute, display grace is not almost reduced. Furthermore, the distraction and the echo by the interface of a substrate and a phase contrast plate are controlled, and deterioration of display grace is prevented.

The liquid crystal display B of the gestalt of example 2 drawing 2 was produced. Between the transparent glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L2 (the nematic liquid crystal BL46 by Merck Co. the chiral agent CB 15 by Merck Co. 42.2wt(s)% mixed thing) of the right-handed rotation which is 530nm. The liquid crystal display component LD 2 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded (the 1st layer) Between the glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L1 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation which is 550nm. Every one liquid crystal display component (the 2nd layer) LD 1 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded was produced, respectively. In addition, in [any] the component, the thing which made the sealing compound (2400 and a curing agent: base resin: ERS- ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as a sealant was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.

[0052] And the liquid crystal display component (the 2nd layer) LD 1 is stuck on the black cardboard S with which adhesives b1 (acrylic binder) are applied to the front face. On the stuck liquid crystal display component LD 1, the adhesives b2 (UV hardenability resin: SE1740 by the Toray Industries Dow-Jones calling silicone company) which added the spacer Sp2 with a particle size of 7 micrometers are applied, and the retardation 275nm phase contrast plate R1 (NITTO DENKO CORP. make R-275) is stuck. Furthermore, the adhesives b2 which added the spacer Sp2 with a particle size of 7 micrometers were applied on the phase contrast plate R1, and the liquid crystal display component (the 1st layer) LD 2 was stuck on it. The location was adjusted, ultraviolet rays were irradiated after that, and adhesives b2 were stiffened so that the pixel of the liquid crystal display component LD 2 of the 1st layer and the liquid

crystal display component LD 1 of the 2nd layer might be mostly in agreement.
[0053] If the pulse voltage of 140V is impressed to each components LD1 and LD2 of the liquid crystal display B obtained in this way, respectively, the liquid crystal layers L1 and L2 of each component will be in a planar condition. And (circular polarization of light of right-handed rotation and left-handed rotation) the component LD 2 of the 1st layer carries out selective reflection [selective reflection / with a peak of 530nm of the right-handed-rotation circular polarization of light / component / LD 1 / of the 2nd layer] with a peak of 550nm of the left-handed-rotation circular polarization of light to incident light.
[0054] With this equipment B both, color mixture is possible by carrying out the laminating of the liquid crystal display components LD1 and LD2 from which it is the thing of the affiliated color to which the peak wavelength of selective reflection belongs to a green wavelength field (about 520nm - 620nm), and the peak wavelength of selective reflection differs mutually. The reflection factor of the peak wavelength of the selective reflection of the liquid crystal display component LD 1 of the direction which is not an incident light side becomes the largest at the time of one half of the peak wavelength of the selective reflection of the liquid crystal display component LD 1 of the direction whose retardation which the phase contrast plate R1 currently pinched has is not an incident light side among the liquid crystal display components LD1 and LD2 which pinch it.
[0055] If the phase contrast plate R1 is adopted and it becomes in ******, the eye component LD 2 will carry out selective reflection with a peak of 530nm in the clockwise circular polarization of light further. Therefore, the light which carries out incidence to the two-layer eye component LD 1 turns into the remainder of the circular polarization of light of the right-handed rotation by which selective reflection was not carried out, and the circular polarization of light of the left-handed rotation which cannot do selective reflection, and, naturally the quantity of light which can carry out selective reflection with the two-layer eye component LD 1 decreases.
[0056] On the other hand, with Equipment B, since the phase contrast plate R1 is inserted, in order to change into the clockwise circular polarization of light the circular polarization of light of the left-handed rotation which has penetrated the 1st layer component LD 2 with the phase contrast plate R1, the quantity of light which can carry out selective reflection with the 2nd layer component LD 1 hardly falls. By the way, if it is easy to reflect the light of short wavelength irregularly, therefore the peak wavelength of selective reflection will make the 2nd layer the short liquid crystal display component LD 2, a part of light is scattered about with the component LD 1 which becomes an optical incidence side, and when light carries out incidence to a component LD 2, incident light will decrease. Furthermore, since a part of light is scattered about with a component LD 1 even if it carries out selective reflection of the incident light, display grace will fall.
[0057] However, with Equipment B, since components LD2 and LD1 are arranged sequentially from the optical incidence side at order with the short selective reflection wavelength of liquid crystal, scattered reflection of the light by the side of short wavelength can be lessened. Although the liquid crystal display B of an example 2 becomes a little low [the peak of selective reflection wavelength] from the liquid crystal display A of said example 1, the wavelength field of the reflected light becomes large.
The liquid crystal display C of the gestalt of example 3 drawing 3 was produced. Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 5 micrometers intervene, and pinches the cholesteric liquid crystal L3 (the nematic liquid crystal BL46 by Merck Co. the chiral agent CB 15 by Merck Co. 45.4wt(s)% mixed thing) of the right-handed rotation which is 480nm. The liquid crystal display component LD 3 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded (the 1st layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L2 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 42.2wt(s)% mixed thing) of the right-handed rotation which is 530nm. The liquid crystal display component LD 2 which closed liquid

crystal by sealant SL so that a viewing area might furthermore be surrounded (the 2nd layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L1 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation which is 550nm. The liquid crystal display component LD 1 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded (the 3rd layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 9 micrometers intervene, and pinches the cholesteric liquid crystal L4 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 32.6wt(s)% mixed thing) of the right-handed rotation which is 680nm. The liquid crystal display component (the 4th layer) LD 4 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded was produced, respectively.

[0058] In addition, in [any] the component, the thing which made the sealing compound (2400 and a curing agent: base resin: ERS- ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as a sealant was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.

[0059] and phase contrast (black cardboard S, 4th layer component LD4, and retardation 150nm) -- phase contrast (plate R21 (NITTO DENKO CORP. make R-150), 3rd layer component LD1, and retardation 150nm) -- in order of plate R22 (NITTO DENKO CORP. make R-150), 2nd layer component LD2, and the 1st layer component LD 3 Carried out the laminating and the glue line c which consists of an acrylic binder which added the spacer Sp2 with a particle size of 7 micrometers was made to intervene between adjacent each class so that the pixel of each component may be in agreement, and it fixed so that the whole might not be shifted.

[0060] the [in addition,] -- the [the phase contrast plate R21 between the 3-4th layer components, and] -- the phase contrast plate R22 between the 2-3rd layer components is the about the same -- although it was a phase differential plate, it has arranged so that each other lagging axis may intersect perpendicularly. If a low-battery pulse is impressed to each liquid crystal display component in the liquid crystal display C obtained in this way, a liquid crystal layer will be in a focal conic condition (black display), i.e., transparence, and if a high-tension pulse is impressed, a liquid crystal layer will be in a planar condition, i.e., the selective reflection condition of a specific color. For example, if the pulse voltage of 140V is impressed to each component, the liquid crystal layer of each liquid crystal display component will be in a planar condition.

[0061] The 1st layer component LD 3 is in within the limits whose peak wavelength of selective reflection is 360nm - 520nm, and reflects blue glow. The peak wavelength of selective reflection is the thing of the affiliated color in within the limits which is 520-620nm, and the 2nd layer component LD 2 and the 3rd layer component LD 1 reflect green light. The 4th layer component LD 4 is in within the limits whose peak wavelength of selective reflection is 620-760nm, and reflects red light. The multicolor display is attained by carrying out the laminating of these components.

[0062] the -- with the phase contrast plate R22 between the 2-3rd layer components, the amount of reflected lights in the 3rd layer component LD 1 increases. When the phase contrast plate R22 is not used, selective reflection with a peak of 530nm is carried out about the clockwise circular polarization of light with the 2nd layer component LD 2. Therefore, the light which carries out incidence to the 3rd layer component LD 1 is the circular polarization of light of the left-handed rotation which cannot do the remainder and selective reflection of the circular polarization of light of the right-handed rotation by which selective reflection was not carried out. Therefore, with the 3rd layer component LD 1, since the circular polarization of light of the right-handed rotation in which selective reflection is possible hardly carries out incidence, the quantity of light which can carry out selective reflection decreases. the phase

contrast plate R22 -- the polarization condition of light -- change **** -- the quantity of light which can be reflected with the 3rd layer component LD 1 can be made to increase by things
[0063] in addition -- for making the amount of reflected lights of the 3rd layer component LD 1 into max -- the -- the magnitude of a retardation should just use the 275nm phase contrast plate which is the one half of the peak wavelength of the selective reflection of the 3rd layer component LD 1 as a phase contrast plate made to pinch between the 2-3rd layer components. By making the retardation of a phase contrast plate fluctuate focusing on 275nm, the reflection factor in the 3rd layer component can be adjusted. In this equipment C that has two liquid crystal display components which have the peak wavelength of selective reflection in the same wavelength field (520-620nm: green light) (there are LD2 and LD1), a green color can be displayed brightly. Moreover, with this type of liquid crystal display, adjustment of color balance can be easily performed only by changing the retardation value of the phase contrast plate to pinch.
[0064] When not using a phase contrast plate, in order to adjust such color balance, modification of the thickness of the liquid crystal layer in a liquid crystal display component and polarization of the driver voltage accompanying it are needed, and adjustment is difficult. the -- the phase contrast plate R21 between the 3-4th layer components -- the -- it is arranged so that 90 degrees of lagging axes may cross to the phase contrast plate R22 between the 2-3rd layer components. the -- the phase contrast plate R22 between the 2-3rd layer components aims at changing the polarization condition of the light which carries out incidence to the component LD 1 of the 3rd layer. the -- the phase contrast plate R21 between the 3-4th layer components has the role which returns the light (the effect of the phase contrast plate R22 between the 2-3rd layer components carrier beam) which has penetrated the 3rd layer component LD 1 to the original condition.
[0065] in order to adjust the reflected light in the 3rd layer component -- the -- light is made into elliptically polarized light with the phase contrast plate R22 between the 2-3rd layer components. the [therefore,] -- if there is no phase contrast plate R21 between the 3-4th layer components, the 4th layer component LD 4 will be influenced of the elliptically polarized light, and the amount of reflected lights will fall. in order to, adjust the amount of reflected lights of green light in short -- the -- if the retardation of the phase contrast plate R22 between the 2-3rd layer components is changed, adjustment will become difficult when it is going to obtain a high reflection factor, since the quantity of light of other colors also changes. the -- the phase contrast plate R21 between the 3-4th layer components -- the -- this problem is solvable by returning the light made into elliptically polarized light with the phase contrast plate R22 between the 2-3rd layer to the original condition. Of course, among the liquid crystal display components of the lot containing the layer which has birefringence, an optical incidence side is effective, also when the laminating of two or more liquid crystal display components is carried out to the opposite hand.
[0066] In the liquid crystal display C, scattered reflection of the light by the side of short wavelength is lessened by carrying out the laminating of the liquid crystal display component to order with short selective reflection wavelength, i.e., the order of LD3 (480nm), LD2 (530nm), LD1 (550nm), and LD4 (680nm), one by one from a top. Thereby, deterioration of display grace is controlled.
The liquid crystal display D of the gestalt of example 4 drawing 4 was produced. Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 5 micrometers intervene, and pinches the cholesteric liquid crystal L5 (the nematic liquid crystal BL46 by Merck Co. the chiral agent CB 15 by Merck Co. 47.6wt(s)% mixed thing) of the right-handed rotation which is 460nm. The liquid crystal display component LD 5 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded (the 1st layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 5 micrometers intervene, and pinches the cholesteric liquid crystal L3 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 45.4wt(s)% mixed thing) of the right-handed rotation which is 480nm. The liquid crystal display component LD 3 which closed liquid

crystal by sealant SL so that a viewing area might furthermore be surrounded (the 2nd layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L2 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 42.2wt(s)% mixed thing) of the right-handed rotation which is 530nm. The liquid crystal display component LD 2 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded (the 3rd layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L1 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation which is 550nm. The liquid crystal display component LD 1 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded (the 4th layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 9 micrometers intervene, and pinches cholesteric-liquid-crystal L6 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 33.8wt(s)% mixed thing) of the right-handed rotation which is 660nm. The liquid crystal display component LD 6 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded (the 5th layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 9 micrometers intervene, and pinches the cholesteric liquid crystal L4 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 32.6wt(s)% mixed thing) of the right-handed rotation which is 680nm. The liquid crystal display component (the 6th layer) LD 4 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded was produced, respectively.

[0067] In addition, in [any] the component, the thing which made the sealing compound (2400 and a curing agent: base resin: ERS- ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as a sealant was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.

[0068] and layer [2nd] component L [phase contrast plate R1 (NITTO DENKO CORP. make R-275), 3rd layer component LD2, and] the phase contrast plate (black cardboard S, 6th layer component LD4, and retardation 340nm) R3 (NITTO DENKO CORP. make R-340) and the 5th layer -- component LD6, 4th layer component LD1, and retardation 275nm -- A laminating is carried out so that the pixel of each component may be in agreement in order of phase contrast plate R4 (NITTO DENKO CORP. make R-240) and the 1st layer component (D3 and retardation 240nm) LD 5. And the glue line d which consists of an acrylic binder which added the spacer Sp2 with a particle size of 7 micrometers was made to intervene between adjacent each class, and it fixed so that the whole might not be shifted.

[0069] If a low-battery pulse is impressed to each liquid crystal display component in the liquid crystal display D obtained in this way, a liquid crystal layer will be in a focal conic condition (black display), i.e., transparence, and if a high-tension pulse is impressed, a liquid crystal layer will be in a planar condition, i.e., the selective reflection condition of a specific color. For example, if the pulse voltage of 140V is impressed to each component, the liquid crystal layer of each liquid crystal display component will be in a planar condition.

[0070] The peak wavelength of selective reflection is the thing of the affiliated color in within the limits which is 360-520nm, and the 1st layer component LD 5 and the 2nd layer component LD 3 reflect blue glow. The peak wavelength of selective reflection is the thing of the affiliated color in within the limits which is 520-620nm, and the 3rd layer component LD 2 and the 4th layer component LD 1 reflect green light. The peak wavelength of selective reflection is the thing of the affiliated color in within the limits

which is 600-760nm, and the 5th layer component LD 6 and the 6th layer component LD 4 reflect red light. The multicolor display is attained by carrying out the laminating of these components.
[0071] The reflection factor of the peak wavelength of the selective reflection of the liquid crystal display component of the direction which is not an incident light side becomes the largest at the time of one half of the peak wavelength of the selective reflection of the liquid crystal display component of the direction whose retardation which the phase contrast plate currently pinched has is not an incident light side among the liquid crystal display components which pinch it. Here, such phase contrast plates R4, R1, and R3 are adopted. The display of a bright high echo can do bright blue, bright green, bright red, bright white, etc. in this way.
[0072] Moreover, if the retardation of a phase contrast plate is made to fluctuate, the color of the reflected light can be adjusted. the -- if the retardation of the phase contrast plate R4 between the 1-2nd layer components is fluctuated from 240nm, the quantity of light of blue glow reflected with the 1st layer component and the 2nd layer component can be adjusted. the same -- the -- if the retardation of the phase contrast plate R1 between the 3-4th layer components is changed -- the quantity of light of green light -- the -- if the retardation of the phase contrast plate R3 between the 5-6th layer components is changed, the amount of red light can be adjusted.
[0073] In short, it can adjust in all the colors of blue, green, and red in three primary colors.
The liquid crystal display component E of the gestalt of example 5 drawing 5 was produced. Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 5 micrometers intervene, and pinches the cholesteric liquid crystal L3 (the nematic liquid crystal BL46 by Merck Co. the chiral agent CB 15 by Merck Co. 45.4wt(s)% mixed thing) of the right-handed rotation which is 480nm. The liquid crystal display component LD 3 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded Two (the 1st layer, the 2nd layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L1 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation which is 550nm. The liquid crystal display component LD 1 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded Two (the 3rd layer, the 4th layer) Among two or more transparence glass substrates G which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 9 micrometers intervene, and pinches the cholesteric liquid crystal L4 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 32.6wt(s)% mixed thing) of the right-handed rotation which is 680nm. Two (the 5th layer, the 6th layer) and a total of six liquid crystal display components were produced for the liquid crystal display component LD 4 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded. ** -- in [any] the component, the thing which made the sealing compound (2400 and a curing agent: base resin: ERS- ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as sealant SL was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.
[0074] and layer [2nd] component L [phase contrast plate R1 (NITTO DENKO CORP. make R-275), 3rd layer component LD1, and] the phase contrast plate (black cardboard S, 6th layer component LD4, and retardation 340nm) R3 (NITTO DENKO CORP. make R-340) and the 5th layer -- component LD4, 4th layer component LD1, and retardation 275nm -- A laminating is carried out so that the pixel of each component may be in agreement in order of phase contrast plate R4 (NITTO DENKO CORP. make R-240) and the 1st layer component (D3 and retardation 240nm) LD 3. And the glue line e which consists of an acrylic binder which added the spacer Sp2 with a particle size of 7 micrometers was made to intervene between adjacent each class, and it fixed so that the whole might not be shifted.

[0075] If the pulse voltage of 140V is impressed to each liquid crystal display component of this liquid crystal display E, the liquid crystal layer of each liquid crystal display component will be in a planar condition. The 1st and the 2nd layer component LD 3 are in within the limits whose peak wavelength of selective reflection is 360-520nm, and reflect blue glow. The 3rd and the 4th layer component LD 1 are in within the limits whose peak wavelength of selective reflection is 520-620nm, and reflect green light. The 5th and the 6th layer component LD 4 are in within the limits whose peak wavelength of selective reflection is 620-760nm, and reflect red light. The multicolor display is attained by carrying out the laminating of these.

[0076] In the peak wavelength of the selective reflection of this liquid crystal display component, a reflection factor becomes the largest at the time of one half of the peak wavelength of the selective reflection of the same liquid crystal display component for which the retardation which a phase contrast plate has pinches it. Here, by carrying out the three-set laminating of the combination set of a phase contrast plate to such a liquid crystal display component, the display of a bright high echo can do bright blue, bright green, bright red, bright white, etc.

[0077] Moreover, if the retardation of a phase contrast plate is made to fluctuate, the color of the reflected light can be adjusted. the -- if the retardation of the phase contrast plate R4 between the 1-2nd layer components is fluctuated from 240nm, the quantity of light of blue glow reflected with the 1st layer component and the 2nd layer component can be adjusted. the same -- the -- if the retardation of the phase contrast plate R1 between the 3-4th layer components is changed -- the amount of green light -- the -- if the retardation of the phase contrast plate R3 between the 5-6th layer components is changed, the amount of red light can be adjusted.

[0078] In short, it can adjust in all the colors of blue, green, and red in three primary colors. This liquid crystal display E can perform the display with the peak wavelength of selective reflection higher than the liquid crystal display D of an example 4. The equipment D of an example 4 has the wavelength field of selective reflection larger than the equipment E of an example 5. Although the whole amount of echoes is almost the same in the examples 4 and 5, in order that only three kinds may use liquid crystal, there is an advantage that manufacture becomes easy, in the example 5.

[0079] In addition, in the liquid crystal display shown in an example 4 and an example 5, since the layer which has birefringence every two liquid crystal display components of an affiliated color is prepared and the circular polarization of light of both right-handed rotation and left-handed rotation may be reflected, the lagging axis of each class which has birefringence can be set as arbitration.

The liquid crystal display F of the gestalt of example 6 drawing 6 was produced. Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 5 micrometers intervene, and pinches the cholesteric liquid crystal L3 (the nematic liquid crystal BL46 by Merck Co. the chiral agent CB 15 by Merck Co. 45.4wt(s)% mixed thing) of the right-handed rotation which is 480nm. The liquid crystal display component LD 3 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded Two (the 1st layer, the 4th layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 7 micrometers intervene, and pinches the cholesteric liquid crystal L1 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation which is 550nm. The liquid crystal display component LD 1 which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded Two (the 2nd layer, the 5th layer) Between the transparence glass substrates G of two or more couples which have the parallel band-like ITO electrodes E1 and E2 of each other The peak wavelength of selective reflection makes the spacer Sp1 with a particle size of 9 micrometers intervene, and pinches the cholesteric liquid crystal L4 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 32.6wt (s)% mixed thing) of the right-handed rotation which is 680nm. Two liquid crystal display components [a total of six] LD 4 (the 3rd layer, the 6th layer) which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded were produced. In addition, in [any] the component, the

thing which made the sealing compound (2400 and a curing agent: base resin: ERS- ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as a sealant was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.
[0080] and black cardboard S and 6th layer component LD 4, and the 5th layer -- phase contrast plate R1 (NITTO DENKO CORP. make R-275) - (component LD1, 4th layer component LD3, and retardation 275nm) -- the 3rd layer in order of component LD4, 2nd layer component LD1, and the 1st layer component LD 3 Carried out the laminating and the glue line f which consists of an acrylic binder which added the spacer Sp2 with a particle size of 7 micrometers was made to intervene between adjacent each class so that the pixel of each component may be in agreement, and it fixed so that the whole might not be shifted.
[0081] If a low-battery pulse is impressed to each liquid crystal display component of this liquid crystal display F, a liquid crystal layer will be in a focal conic condition (black display), i.e., transparence, and if a high-tension pulse is impressed, a liquid crystal layer will be in a planar condition, i.e., the selective reflection condition of a specific color. For example, if the pulse voltage of 140V is impressed to each component, the liquid crystal layer of each liquid crystal display component will be in a planar condition.
[0082] The clockwise circular polarization of light (they are blue glow, green light, and red light to sequence, respectively) is reflected with each component of the 1st, the 2nd, and the 3rd layer. The counterclockwise circular polarization of light penetrates the 1st - the 3rd layer component, and they carry out incidence to the phase contrast plate R1. The counterclockwise circular polarization of light's transparency of the retardation 275nm phase contrast plate R1 changes it into elliptically polarized light with 550nm near [the counterclockwise circular polarization of light and other wavelength] the counterclockwise circular polarization of light. This light carries out incidence to the 4th, the 5th, and the 6th layer component, and blue glow, green light, and red light are reflected in order, respectively.
[0083] According to this liquid crystal display F, the high reflection factor near the equipment E of an example 5 is obtained only by using one phase contrast plate in 3 color laminating mold liquid crystal display. Of course, if it is the thing of the affiliated color from which the peak wavelength of selective reflection differs mutually even if each component of the 3rd and the 6th layer [the 1st the 4th layer, the 2nd, the 5th layer, and] is not the same, a reflection factor may be improved too.
The liquid crystal display Y of the gestalt of example 7 drawing 7 was produced. Have the parallel band-like ITO electrodes E1 and E2 of each other [plurality], and between two film substrates Yf whose retardations are 100nm The peak wavelength of selective reflection makes the spacer Sp1 with a thickness of 7 micrometers intervene, and pinches the cholesteric liquid crystal L1 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation which is 550nm. Two liquid crystal display components LDy which closed liquid crystal by sealant SL so that a viewing area might furthermore be surrounded were produced. These two liquid crystal display components are the same liquid crystal display components with completely same a production ingredient and production conditions. In addition, in [any] the component, the thing which made the sealing compound (2400 and a curing agent: base resin: ERS- ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as a sealant was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.
[0084] And one liquid crystal display component (the 2nd layer) LDy is stuck on the black cardboard S with which the adhesives y which are acrylic binders which added the spacer Sp2 with a particle size of 7 micrometers are applied to the front face, and the retardation 240nm phase contrast plate R4 (NITTO DENKO CORP. make R-240) is stuck on it by the glue line y which is the acrylic binder which added the spacer Sp2 with a particle size of 7 micrometers. Furthermore, on it, the liquid crystal display component (the 1st layer) LDy is stuck by the glue line y so that the component and pixel of the 2nd

layer may be in agreement.
[0085] With this equipment LDy, there will be two kinds of methods of changing a retardation by having used the substrate Yf which has birefringence in addition to the image with which the reflection factor has been improved as the example 1 explained being observable. That is, blindness in one eye is the approach of changing the retardation of a phase contrast plate, and another is the approach of changing the retardation of Substrate Yf which has birefringence. The width of face of selection of an ingredient has spread so much in this way.
The liquid crystal display Z of the gestalt shown in example 8 drawing 8 was produced. Mutually [plurality] the parallel band-like ITO electrode E1 It has. A retardation Zero substrates (Transparence glass substrate etc.) Cholesteric liquid crystal Lz1 (nematic liquid crystal by Merck Co.) of the right-handed rotation whose peak wavelength of selective reflection is 550nm among the substrates (PES substrate etc.) G2 of G1 and plurality whose retardations it has the parallel band-like ITO electrode E2 of each other, and are 275nm BL46 -- the chiral agent CB 15 by Merck Co. -- 40wt(s)% -- the spacer Sp1 with a particle size of 7 micrometers being made to intervene, and what was mixed being pinched, and with the liquid crystal display component (the 1st layer) LDz1 which closed liquid crystal by sealant SL so that a viewing area might be surrounded further Mutually [plurality] the parallel band-like ITO electrodes E1 and E2 Have and a retardation the cholesteric liquid crystal Lz1 (nematic liquid crystal by Merck Co. to BL46 the chiral agent CB 15 by Merck Co. 40wt(s)% mixed thing) of the right-handed rotation whose peak wavelength of selective reflection is 550nm between two film substrates G3 of 0 The spacer Sp1 with a particle size of 7 micrometers was made to intervene, it pinched, and one liquid crystal display component (the 2nd layer) LDz2 which closed liquid crystal by sealant SL so that a viewing area might be surrounded further was produced, respectively. In addition, in [any] the component, the thing which made the sealing compound (2400 and a curing agent: base resin: ERS-ERS- thing which mixed 2480 by 1:1) by Sumitomo Bakelite Co., Ltd. distribute the spacer Sp1 with a particle size of 7 micrometers as sealant SL was used. Moreover, in pinching liquid crystal between substrates, it is made for the sense of the ITO electrodes E1 and E2 of a vertical substrate to intersect perpendicularly, and was made for the part which an up-and-down ITO electrode intersects to serve as a pixel.
[0086] And the liquid crystal display component (the 2nd layer) LDz2 is stuck on the black cardboard S with which the acrylic binder z is applied to the front face. The acrylic binder z which added the spacer Sp2 with a particle size of 7 micrometers is applied on the stuck liquid crystal display component, and on it, the liquid crystal display component (the 1st layer) LDz1 is stuck so that the component and pixel of the 2nd layer may be in agreement. It is made for the substrate G2 which has birefringence to be on a glue line side.
[0087] According to this liquid crystal display, there is the same advantage as the liquid crystal display of an example 1. Furthermore, since the substrate which has birefringence as a substrate of a liquid crystal display component is used, a phase contrast plate is omissible, and since the number of the interfaces between a substrate and the layer which has birefringence becomes fewer from the liquid crystal display of an example 1, the total amount of the scattered reflection generated in respect of each field becomes small (since it is the configuration of having omitted the interface of a glue line / phase contrast plate). Thereby, good display grace is acquired. There is also an advantage that there are still few adhesion processes than the liquid crystal display of an example 1.
The solid image display system DS which consists of the liquid crystal display and observation equipment of a gestalt of example 9 drawing 9 was produced.
[0088] A liquid crystal display is a liquid crystal display component which has the liquid crystal in which the cholesteric phase which has selective reflection wavelength in a light region is shown. The liquid crystal display section Dd which the phase contrast plate Rt was made to intervene, and carried out the laminating of 1st [which displays by reflecting the incident light of the respectively same circular polarization of light], and 2nd liquid crystal display component LDalpha, and the LDbeta, and formed the glue line gamma between each next door ******, and fixed the whole, It has the actuation control section CONT which can drive 1st element LDalpha and 2nd element LDbeta, respectively. In

addition, in drawing 9 , S is black cardboard pasted up on the underside of 2nd layer component LDbeta by the glue line gamma.
[0089] In the display Dd of drawing 9 , 1st layer component LDalpha is a component which reflects incident light, as observed as a light of the counterclockwise circular polarization of light, and 2nd layer component LDbeta is a component which reflects incident light so that it may be observed in the 1st layer by existence of the phase contrast plate Rt as a light of the circular polarization of light of reverse, for example, the clockwise circular polarization of light. The actuation control section CONT can be driven so that the image which has parallax for 1st layer component LDalpha and 2nd layer component LDbeta mutually may be displayed.
[0090] On the other hand, observation equipment consists of glasses GL which have arranged the filter which penetrates the counterclockwise circular polarization of light for the filter which penetrates the clockwise circular polarization of light on right-hand side on left-hand side. By seeing the image (for example, the image LI for left eyes and the image for right eyes (RI) of drawing 9) displayed on 1st and 2nd liquid crystal display component LDalpha and LDbeta, respectively through Glasses GL in this way, the display (reflected light) of 2nd layer component LDbeta is visible to a right eye, the display (reflected light) of 1st layer component LDalpha is visible to a left eye, and a solid image can be observed in this way.
[0091] When the liquid crystal display shown in example 1 and 2 grades is used as a display Dd, a monochromatic three-dimension image can be observed. When the liquid crystal display shown in example 4, 5, and 6 grades is used, the three-dimension image of a color can be observed. If it is made to drive so that the 1st and the same image as the 2nd element may be displayed by the actuation control section CONT, of course, as each previous example explained, the image with which the reflection factor has been improved is observable by the naked eye.
[0092] Moreover, if the laminating of the layer which has the birefringence which changes the circular polarization of light into the front face (observation side) of Display Dd at the linearly polarized light is carried out, and two polarizing plates (two polarizing plates with which the polarization shaft lies at right angles mutually) are used instead of the circular polarization of light filter of two sheets in glasses, a solid image is observable the same with having used the circular polarization of light filter. In addition, in said each example, although explained by mentioning a concrete matter name, this is an example to the last and it is possible for the liquid crystal display component of this invention not to be restricted to these matter, and to use various kinds of ingredients. For example, it is also possible to use the liquid crystal layer of the so-called macromolecule distributed process input output equipment which comes to distribute liquid crystal in a resin matrix.
[0093]
[Effect of the Invention] According to this invention, even if display grace is high and adjustment of color balance is easy, and it can display a two-dimensional image brightly and makes it highly minute against an oscillation or an impact strongly in desired color balance, deterioration of image display grace can offer few liquid crystal displays. Moreover, according to this invention, even if it can also perform the display of a three-dimension image and it not only can display a two-dimensional image brightly, but makes it highly minute against an oscillation or an impact strongly in desired color balance, deterioration of image display grace can offer few liquid crystal displays.

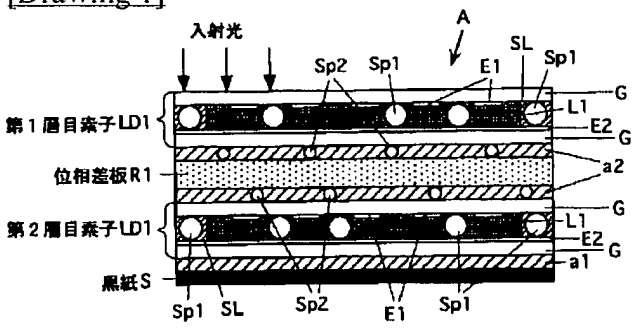
[Translation done.]

* NOTICES *

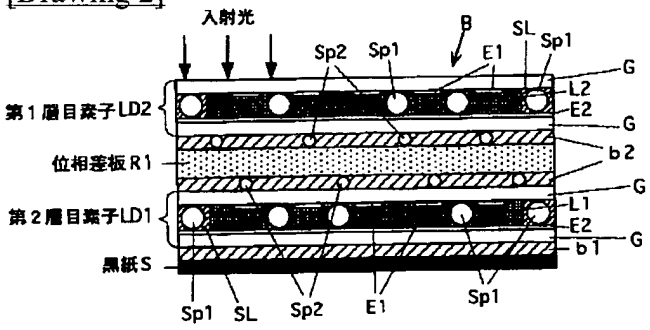
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

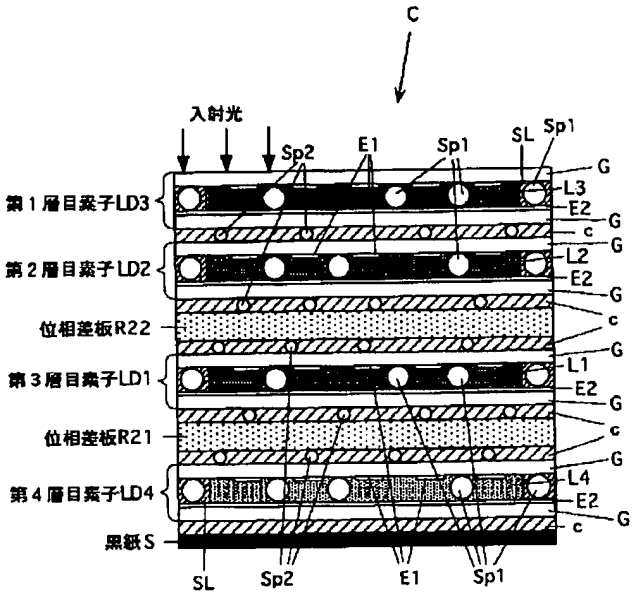
[Drawing 1]



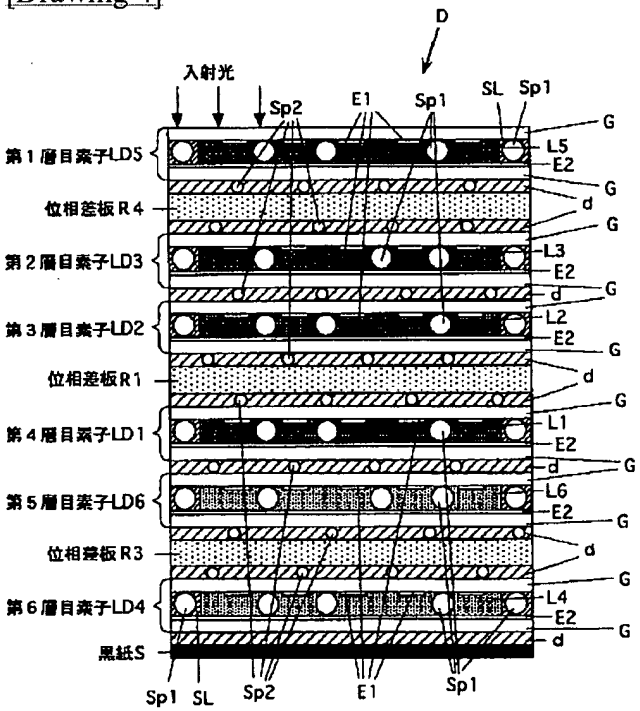
[Drawing 2]



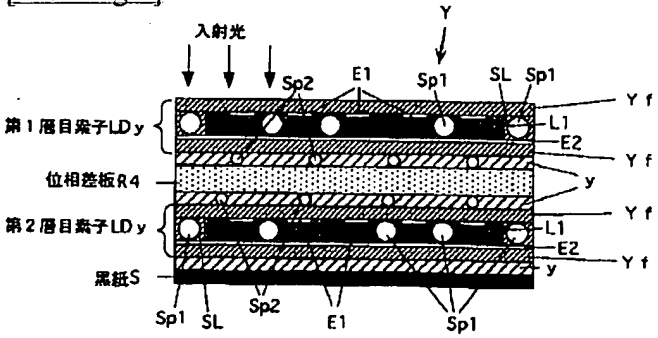
[Drawing 3]



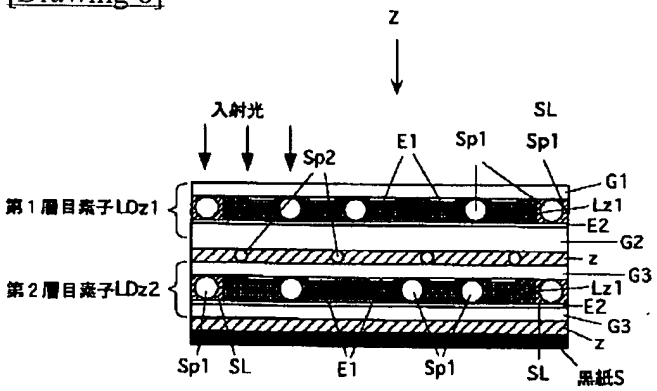
[Drawing 4]



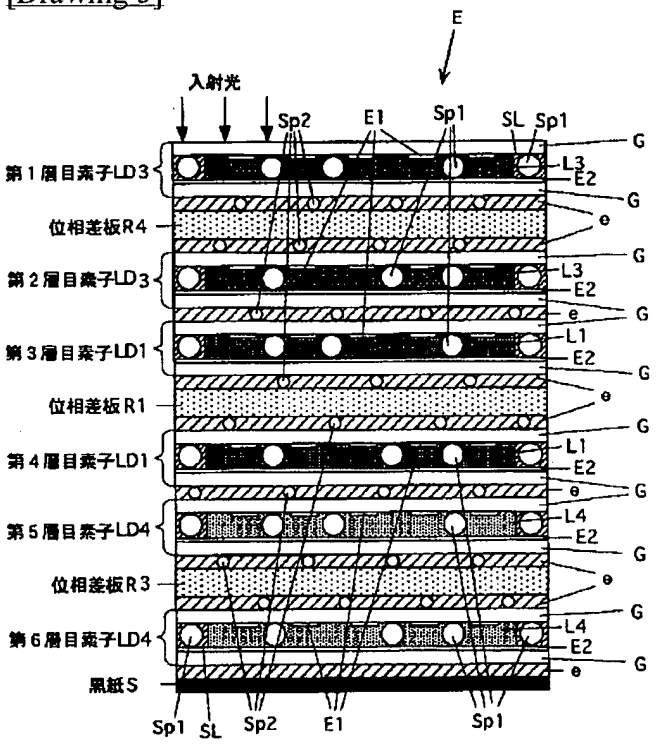
[Drawing 7]



[Drawing 8]



[Drawing 5]



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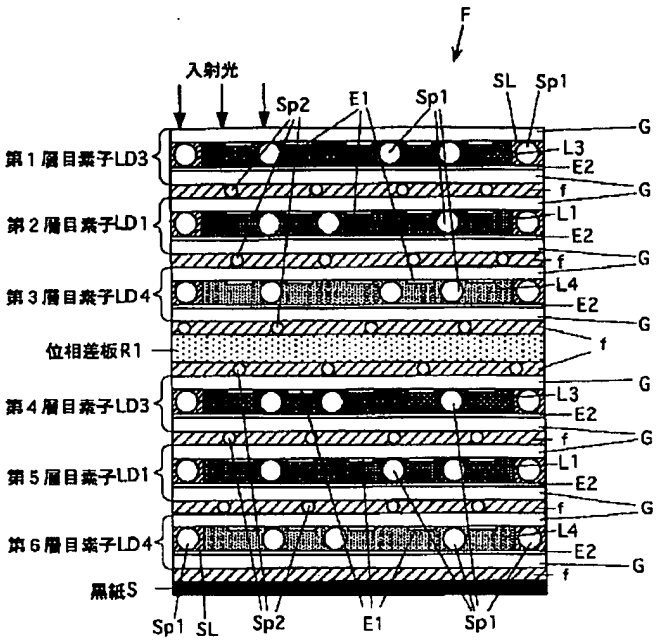
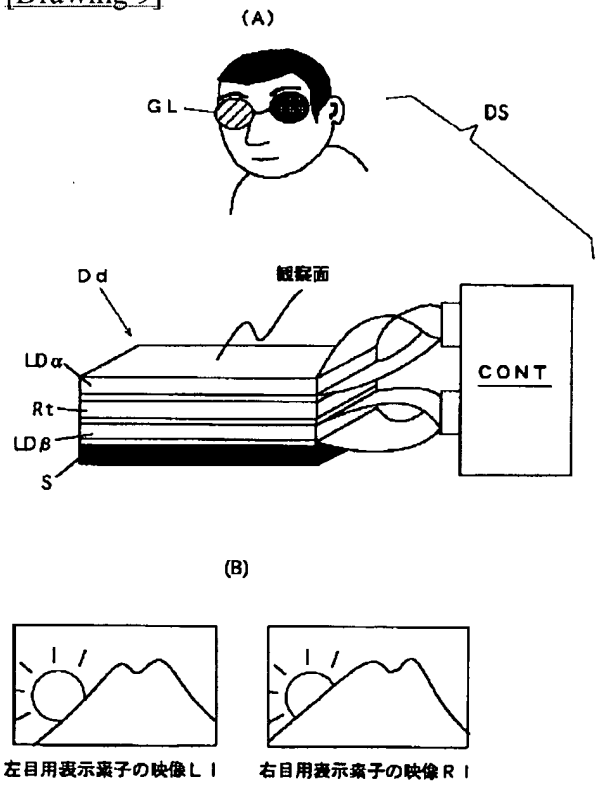
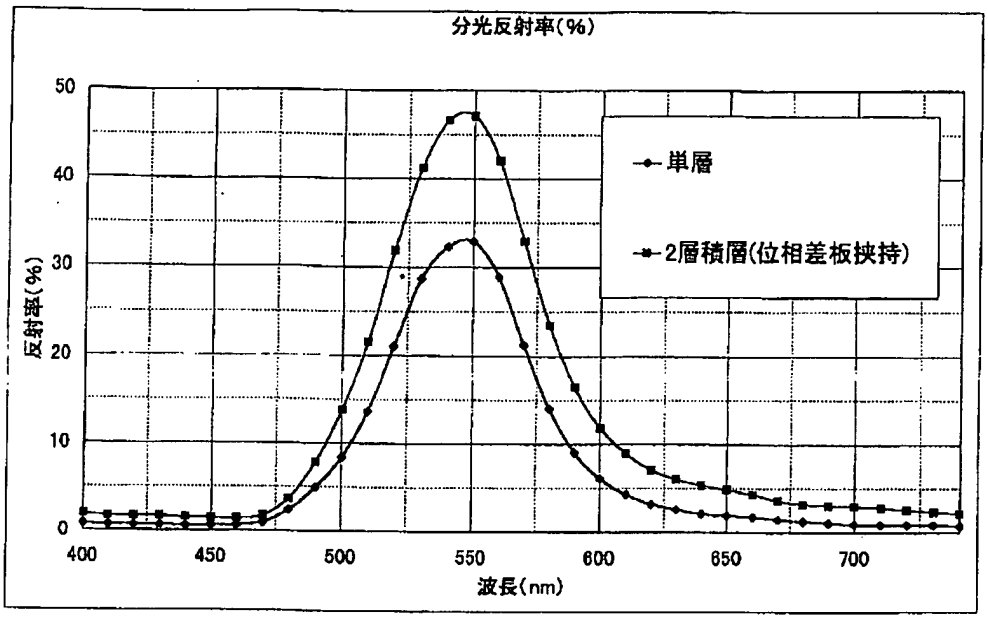


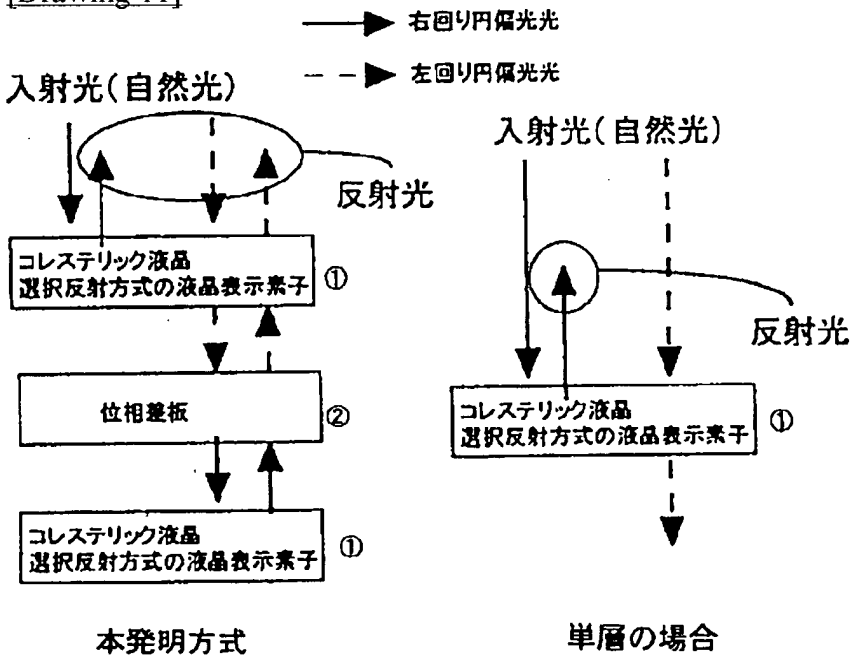
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]